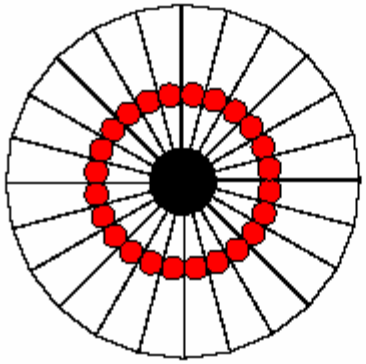
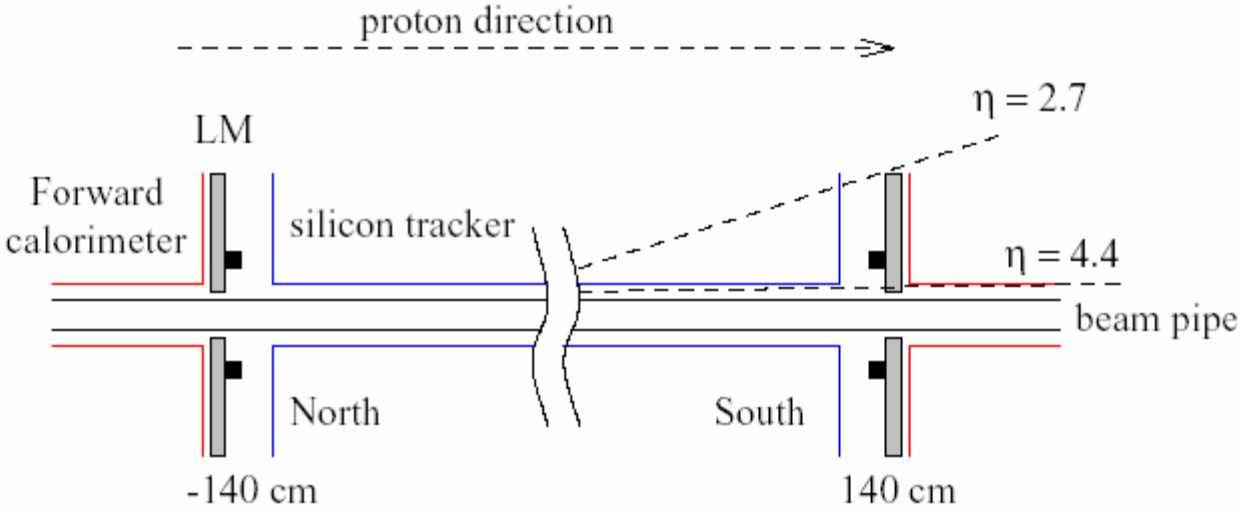
DØ Lum Updates

B. Casey, 11/01/05

- Review old system and problems
- New readout system
- Tests
- Absolute scale

Luminosity Detector





- Two arrays of forward scintillator
- Inelastic collision identified using coincidence of hits in two arrays

Old Readout System

- Analog sum of 24 counters on each side.
- One discriminator for each side.
- Custom TDC measures time difference between signals from the two arrays.

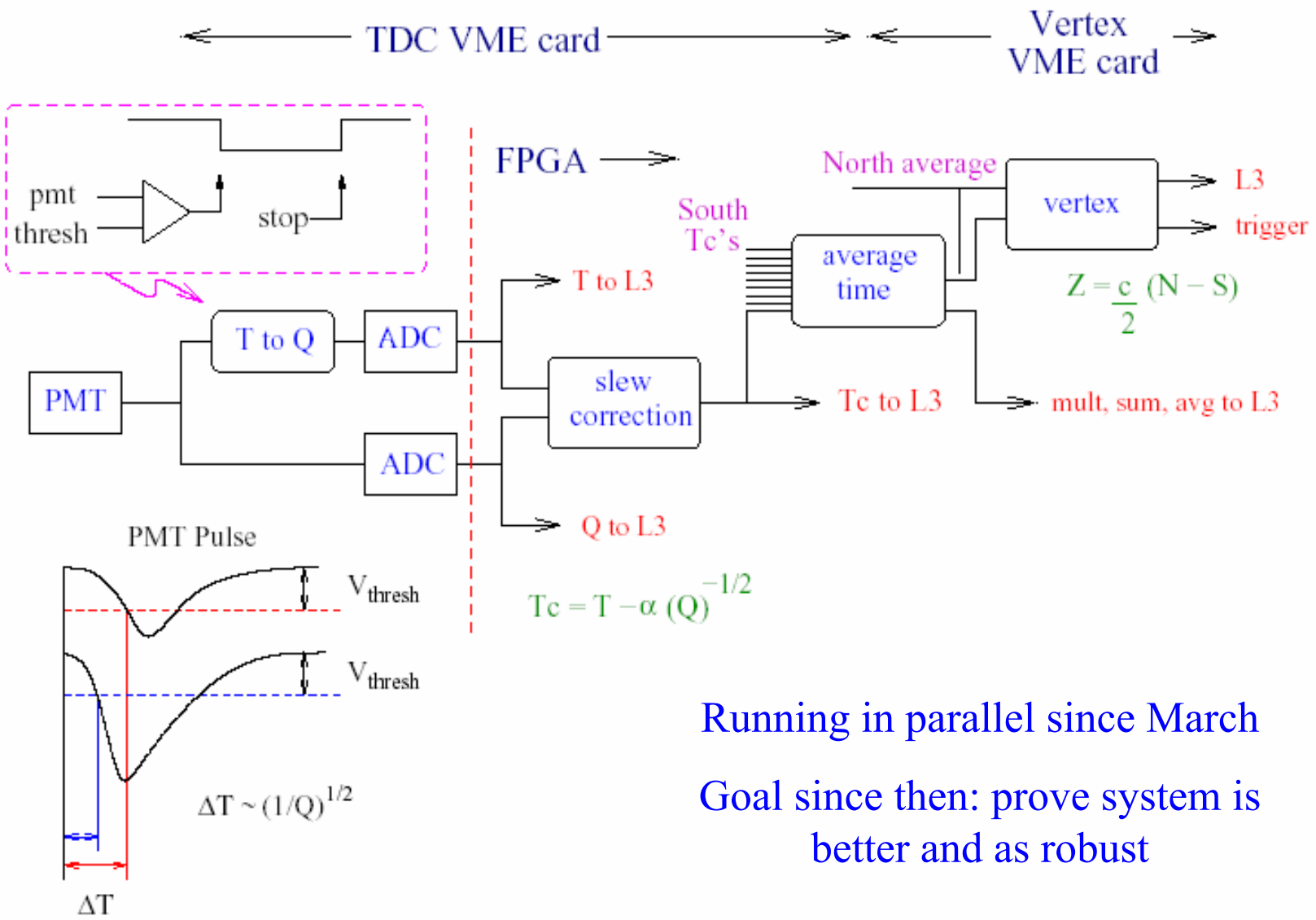
- Problems:
  - Early hit in any channel causes timing to be screwed up for entire crossing.
    - Order 10% deadtime corrections at 100e30.
  - Large dynamic range. Difficult to be efficient for single hits and at the same time not saturate electronics in high multiplicity crossings.
    - Operating at low HV giving order 90% efficiency for inelastic collisions.

New Readout System

- Each channel discriminated separately.
- Timing cuts placed on each channel to remove out of time hits
- Fully integrated in the DØ readout chain allowing for offline studies.

- Solutions:
  - Deadtime: Early hits removed channel by channel
    - Basically no deadtime
  - Dynamic range: No analog sum, no dynamic range problem
    - Can increase the HV to get ~100% efficiency for inelastic collisions

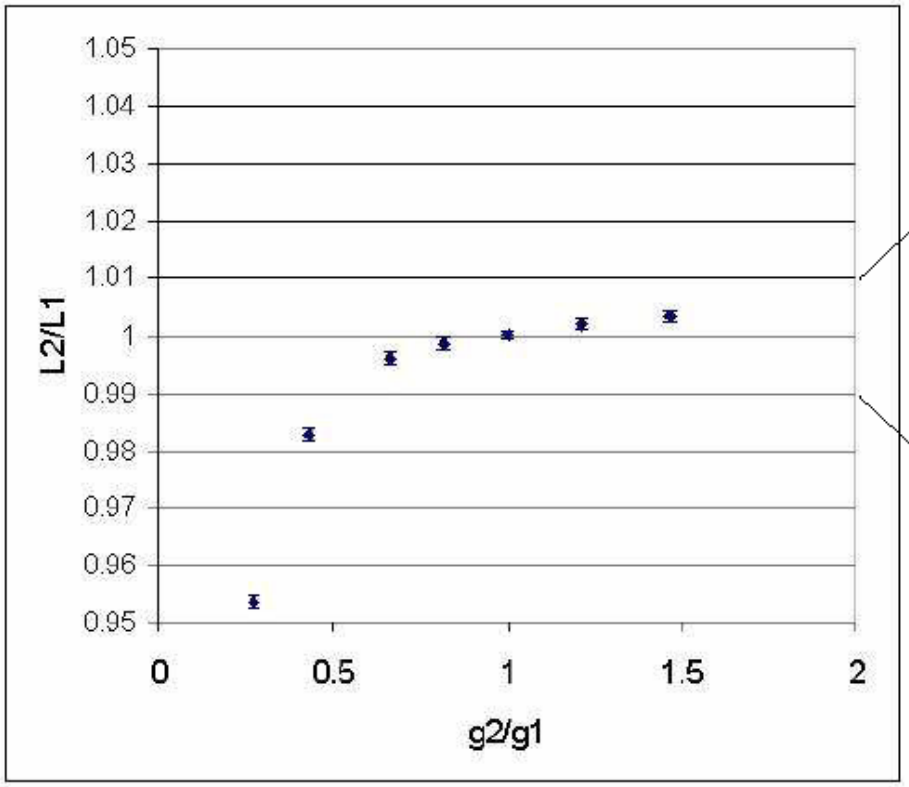
New Readout System

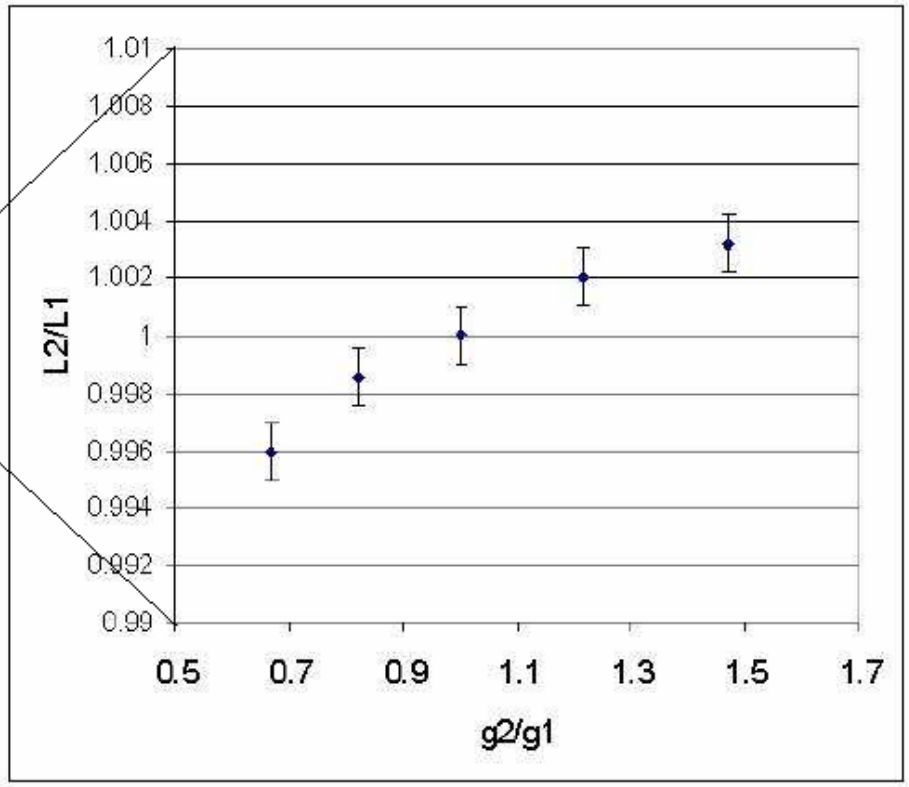


Running in parallel since March

Goal since then: prove system is better and as robust

New HV

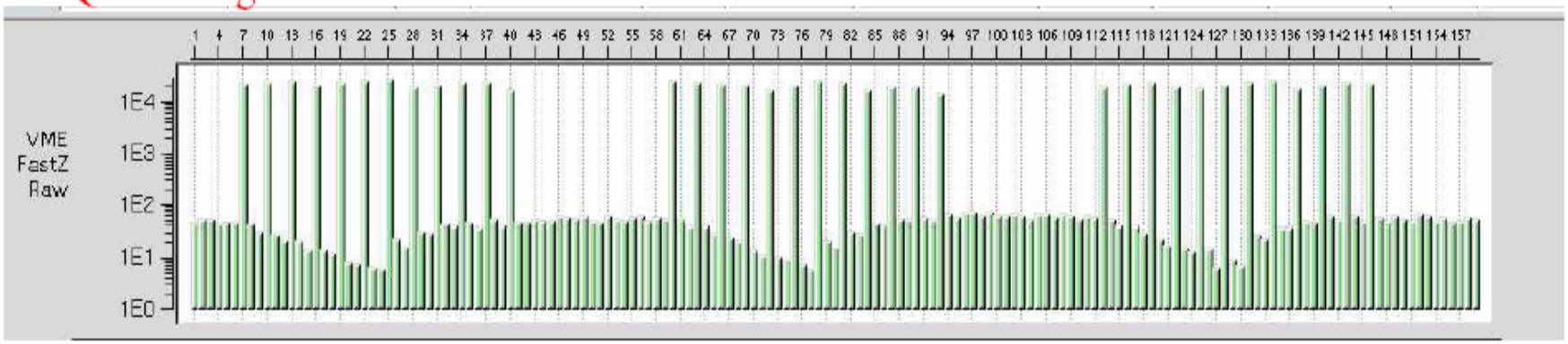




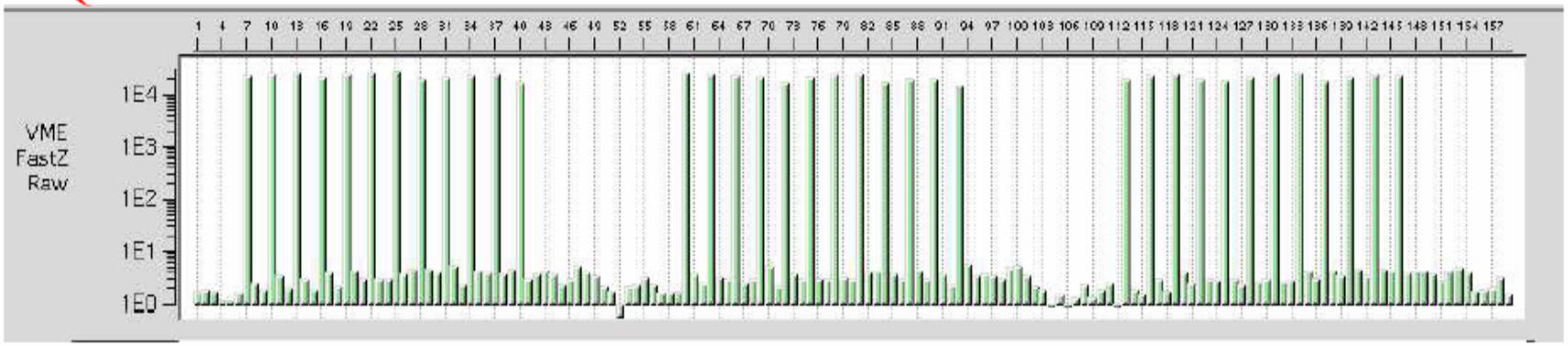
- Have increased the gain on PMTs by ~2x
- Further increase of ~1.5 only increases efficiency by 0.3%, plateaued.
- Aging studies indicate no problems for >> 8 fb^{-1}

Tests 1: Backgrounds

DAQ Running

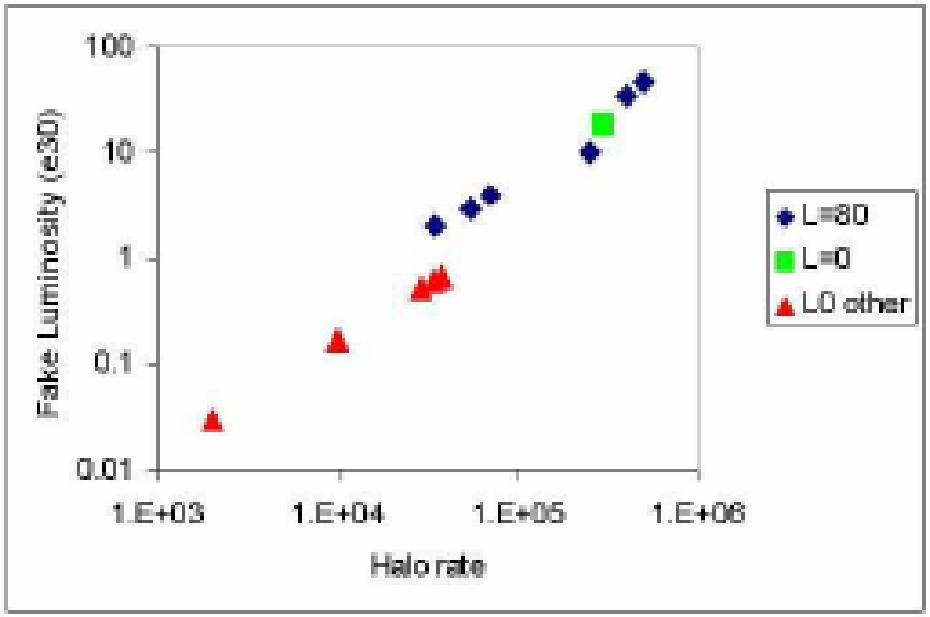


DAQ Paused



- Out of time backgrounds can be studied using off-tick data
- Apply a background subtraction online based on average of adjacent ticks

Tests 2: Halo

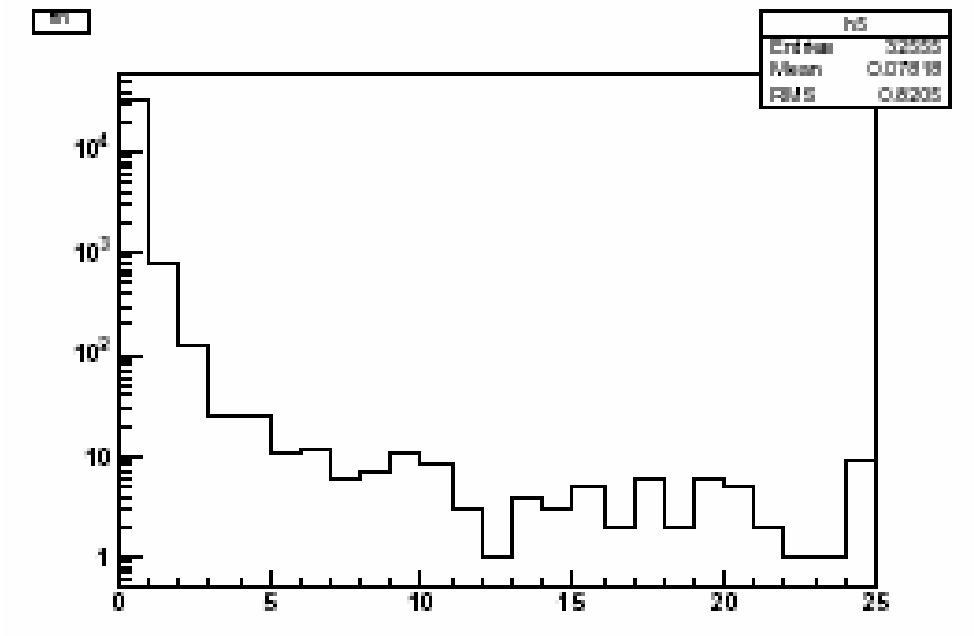


- Nominal halo signals are early and are removed by timing cuts.
- Due to finite beam width and resolution, some halo particles arrive in-time

- Studied using ‘halo spikes’ in beam studies, shot setup, and HEP.
- Negligible effect on luminosity (~0.1e30) for halo rates below 10 kHz.

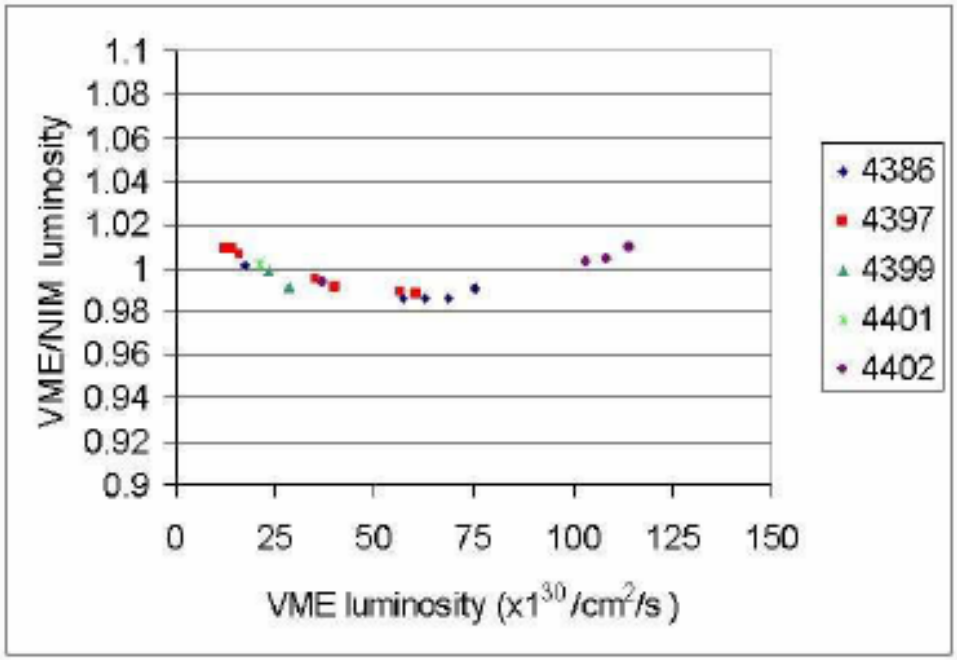
Tests 3: Deadtime

Multiplicity in one array for early hits



- New system has basically no deadtime since early hits are removed channel by channel
- Still a finite probability for coincidence of high multiplicity early event in a low multiplicity crossing
- Keeping deadtime correction in place based on presence of early hits (but has no effect so far)

Absolute Scale



- Scaled new system to equal old system while we determine absolute scale of the new system
- Additional info in the readout plus higher efficiency allow more robust procedures. Particularly for MC tuning.

Conclusions

- New readout system online since March, default since end of store 4460.
- Essentially free of the deadtime and dynamic range problems of the old system.
- Now finalizing absolute scale.